SET -*1*

Kendriya Vidyalaya Sangathan Bhopal Region

Pre Board Examination

Class XII - Mathematics

Session 2024-25

MARKING SCHEME

SECTION –A		
Q.1.	(b) $A^2 + B^2$	1
Q.2.	(b)10	1
Q.3.	(a) Always increasing	1
Q.4.	(b)– 81	1
Q.5.	(c) $x = \cot y + c$	1
Q.6.	(b)18	1
Q.7.	(a) b= - c	1
Q.8.	(b) 1	1
Q.9.	(d) $5\sqrt{2}$	1
Q.10.	(c)Either **a** or **b** is a null vector	1
Q.11.	(a) 134	1
Q.12.	(b) $\sec x - \tan x + x + c$	1
Q.13.	(b) $\frac{1}{2}$	1
Q.14.	(a) $x^2 + 1$	1
Q.15.	(b) $\frac{\pi}{3}$	1
Q.16.	(b) $2x + y \geq 2,\ x - y \leq 1,\ x + 2y \leq 8$	1
Q.17.	(a) For all real values of *x*	1
Q.18.	(d) 1	1
.	**ASSERTION-REASON BASED QUESTIONS**	
Q.19.	(C) (A) is true but (R) is false.	1
Q.20.	(A) Both (A) and (R) are true and (R) is the correct explanation of (A).	1
SECTION –B		
Q.21.	Let y= f(x) $= \cos^{-1}\frac{3x-1}{2}$ $-1 \leq \frac{3x-1}{2} \leq 1$ $\Rightarrow \frac{-1}{3} \leq x \leq 1 \therefore$ Domain = $[\frac{-1}{3}, 1]$	 1 1
Q.22.	Let variable edge of cube at time t be x Volume at time t will be V = x^3	

	$\Rightarrow \frac{dV}{dt} = 3x^2\frac{dx}{dt}$ $\Rightarrow 8 = 3x^2\frac{dx}{dt} \quad \therefore \frac{dx}{dt} = \frac{8}{3x^2}$ Surface area at time t , S = $6x^2$ $\Rightarrow \frac{dS}{dt} = 12x\frac{dx}{dt} = 12x \times \frac{8}{3x^2}$ $\Rightarrow \frac{dS}{dt} = \frac{32}{x}$ At x = 12 $\frac{dS}{dt} = \frac{8}{3}\ cm^2/s$	1 0.5 0.5
Q.23.	derivative of $\log x$ with respect to x = $\frac{1}{x}$ derivative of $\tan^{-1} x$ with respect to x = $1/_{1+x^2}$ $\therefore$ the derivative of $\log x$ with respect to $\tan^{-1} x = \frac{1+x^2}{x}$ **OR** $f(x) = x^{\cos x}$ On taking log of both sides $\log f(x) = \cos x . \log x$ Diff wrt. X $$f'(x) = x^{\cos x}\left(-\sin x . \log x + \frac{\cos x}{x}\right)$$	0.5 0.5 1 OR 1 1
Q.24.	the sum of the vectors $(2\mathbf{i}+4\mathbf{j}-5\mathbf{k})$ and $(b\mathbf{i}+2\mathbf{j}+3\mathbf{k})$ = $(2+b)\mathbf{i}+6\mathbf{j}-2\mathbf{k}$ Unit vector along sum = $\frac{(2+b)\mathbf{i}+6\mathbf{j}-2\mathbf{k}}{\sqrt{(2+b)^2+36+4}}$ ATQ $\frac{(2+b)+6-2}{\sqrt{(2+b)^2+36+4}}$ =1 $\Rightarrow$ b=1 **OR** To find correct sum and difference $\bar{a} + \vec{b} = \hat{\imath} + \hat{\jmath} + \hat{k} + \hat{\imath} + 2\hat{\jmath} + 3\hat{k} = \widehat{2\imath} + 3\hat{\jmath} + 4\hat{k}$ and $\bar{a} - \vec{b} = = \hat{\imath} + \hat{\jmath} + \hat{k} - \hat{\imath} - 2\hat{\jmath} - 3\hat{k} = 0\hat{\imath} - \hat{\jmath} - 2\hat{k}$ To find correct $(\bar{a} + \vec{b}) \times (\bar{a} - \vec{b})$and correct unit vector	1 1 OR 1 1
Q.25.	Using vectors , find the area of the ΔABC with vertices A (1,1,1) , B (1,2 , 3) and C (2 ,3, 1) $\overrightarrow{AB} = \hat{\jmath} + 2\hat{k}$, $\overrightarrow{AC} = \hat{\imath} + 2\hat{\jmath}$ Area of triangle ABC = $\frac{1}{2}\left\lvert \overrightarrow{AB} \times \overrightarrow{AC} \right\rvert = \frac{\sqrt{21}}{2}$ Sq. Units	1 1
	SECTION –C [3$\times$ 6 = 18]	
Q.26.	$\frac{dy}{dx} = \frac{x^2+y^2}{2xy}$ Put y=vx V+ x$\frac{dv}{dx} = \frac{1+v^2}{2v}$	1

	$x\frac{dv}{dx} = \frac{1-v^2}{2v}$ on separating variable $\frac{2v}{1-v^2}\, dv = \frac{dx}{x}$ On integrating and solving $x^2 - y^2 = cx$ ∵ curve passing through a point (2, 1) ∴ 4 – 1 = 2c ⇒ c =3/2 Equation of curve is $2(x^2 - y^2) = 3x$ **OR** The differential equation $\frac{dy}{dx} + y\sec^2 x = \tan x \sec^2 x$ the differential equation is linear in x Integrating factor IF = $e^{\int P dx} = e^{\tan x}$ General solution : y. $e^{\tan x} = \int \tan x \sec^2 x\, e^{\tan x} dx$ +C put $\tan x = t$ y. $e^{\tan x} = \int te^t dt$ +C On solving Y= $\tan x - 1 + Ce^{-\tan x}$	1 1 OR 1 1 1
Q.27.	Find the intervals in which function $f(x) = \sin 3x$, $x \in \left[0, \frac{\pi}{2}\right]$ is : (a) strictly increasing (b) strictly decreasing $f(x) = \sin 3x$ Diff wrt x $f'(x) = 3\cos 3x$ Put $f'(x) = 0$ ⇒ $3\cos 3x = 0$ ⇒ x = $\frac{\pi}{6}$ (a) strictly increasing in $[0, \frac{\pi}{6})$ (b) strictly decreasing in $(\frac{\pi}{6}, \frac{\pi}{2}]$	1 1 1
Q.28.	∵ $\overline{\beta_1}$ is parallel to $\bar{\alpha}$ ⇒ $\overline{\beta_1} = \lambda\, \bar{\alpha} = \lambda\,(3\hat{\imath} - \hat{\jmath})$ And $\overline{\beta_2} = \bar{\beta} - \overline{\beta_1}$ ∵ $\overline{\beta_2}$ is perpendicular to $\bar{\alpha}$ $\overline{\beta_2} \cdot \bar{\alpha} = 0$ ⇒ $(\bar{\beta} - \overline{\beta_1}).\bar{\alpha} = 0$ ⇒ $\lambda = \frac{1}{2}$ ∴ $\overline{\beta_1} = \lambda\,\bar{\alpha} = \lambda\,(3\hat{\imath} - \hat{\jmath}) = \frac{1}{2}(3\hat{\imath} - \hat{\jmath})$ and $\overline{\beta_2} = \bar{\beta} - \overline{\beta_1} = 2\hat{\imath} + \hat{\jmath} - 3\hat{k} - \frac{1}{2}(3\hat{\imath} - \hat{\jmath}) = \frac{1}{2}(\hat{\imath} + 3\hat{\jmath} - 6\hat{k})$	1 1

	OR ∵ **a** is perpendicular to both **b** and **c** ⇒ **a** is parallel to **b** × **c** ⇒ **a** =λ(**b** × **c**) --------------------------(1) ⇒ $\lvert\mathbf{a}\rvert = \lvert\lambda(\mathbf{b} \times \mathbf{c})\rvert$ ⇒ $\lvert\mathbf{a}\rvert = \lvert\boldsymbol{\lambda}\rvert\lvert(\mathbf{b} \times \mathbf{c})\rvert$ ⇒ $\lvert\mathbf{a}\rvert = \lvert\boldsymbol{\lambda}\rvert\lvert\mathbf{b}\rvert\lvert\mathbf{c}\rvert \sin\frac{\pi}{6}$ ⇒ $\lvert\mathbf{a}\rvert = \lvert\boldsymbol{\lambda}\rvert\lvert\mathbf{b}\rvert\lvert\mathbf{c}\rvert \sin\frac{\pi}{6}$ ⇒ $1 = \lvert\boldsymbol{\lambda}\rvert \,\mathbf{sin}\,\frac{\boldsymbol{\pi}}{\mathbf{6}}$ ∵ **a ,b ,c** are unit vectors ⇒ $\lvert\lambda\rvert = 2$ ⇒λ =±2 From equation (1) **a** = $\pm 2(\boldsymbol{b} \times \boldsymbol{c})$	1 OR 1 1 1
Q.29.	$\int \frac{e^x(x-3)}{(x-1)^3}dx$ $=\int \frac{e^x(x-1-2)}{(x-1)^3}dx$ $= \int e^x\left(\frac{1}{(x-1)^2} - \frac{2}{(x-1)^3}\right)dx$ $=\int e^x(f(x) + f'(x))dx$ $= e^x f(x) + C$ $= \frac{e^x}{(x-1)^2} + C$ **OR** $I = \int_{-2}^{2} \frac{x^2}{1+5^x}dx$ ------------------- (1) $= \int_{-2}^{2} \frac{x^2}{1+5^{-x}}dx$, By King's property $I = \int_{-2}^{2} \frac{5^x x^2}{1+5^x}dx$ -------------------(2) On adding eq. (1) and eq. (2) $2I = \int_{-2}^{2}\left(\frac{x^2}{1+5^x} + \frac{5^x x^2}{1+5^x}\right)dx$ $2I = \int_{-2}^{2} x^2\, dx = \frac{16}{3}$ $\therefore I = \frac{8}{3}$	1 1 1 OR 1 1 1
Q.30.	Minimise Z= x + 2y Subject to 2x+y≥3 , x+2y ≥ 6 , x≥0 , y≥0 . For correct feasible region For correct corner points and minimum value =6 To show graphically that the minimum of Z occurs at more than two points	1 1 1
Q.31	Let X = No. of defective bulbs = 0,1,2 ∵ balls are drawn without replacement	1 1

P(X=0) = $\frac{9}{21}$, P(X=1) = $\frac{10}{21}$, P(X=2) = $\frac{2}{21}$

∴ Probability dist of X :

X	0	1	2
P(X)	$\frac{9}{21}$	$\frac{10}{21}$	$\frac{2}{21}$

1

Mean = $\sum P.X = \frac{2}{3}$ = 0.66666 ≈ 0.67

OR

OR

Probability of solving specific problem independently by A and B are

P(A) = $\frac{1}{2}$ and P(B)= $\frac{1}{3}$ respectively

(I) Probability problem is solved = 1− Probability problem is not solved

$= 1 - P(\overline{A} \cap \overline{B})$

$= 1 - P(\overline{A})\, P(\overline{B})$

∵ A and B are independent events ∴ $\overline{A}$ and $\overline{B}$ also independent events 1.5

$= 1 - \frac{1}{2} \times \frac{2}{3} = \frac{2}{3}$

(ii) Probability exactly one of them solves the problem 1.5

$= P(\overline{A} \cap B) + P(A \cap \overline{B}) = \frac{1}{2} \times \frac{1}{3} + \frac{1}{2} \times \frac{2}{3} = \frac{1}{2}$

SECTION –D [5× 4 = 20]

Q.32.

For correct graph 2

To identify correct area and formula 1

For finding correct area 3 sq. units 2

Q.33.

$$\begin{bmatrix} 1 & -1 & 2 \\ 0 & 2 & -3 \\ 3 & -2 & 4 \end{bmatrix} \begin{bmatrix} -2 & 0 & 1 \\ 9 & 2 & -3 \\ 6 & 1 & -2 \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$ 2

AB = I

$\Rightarrow A^{-1} = B$ or $B^{-1} = A$

System of equation

x + 3z = 9 , -x +2y – 2z =4 and 2x – 3y + 4z = 3

Matrix representation of the system of equation

$$\begin{bmatrix} 1 & 0 & 3 \\ -1 & 2 & -2 \\ 2 & -3 & 4 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 9 \\ 4 \\ 3 \end{bmatrix}$$ 1

A’X=C 1

⇒ X = $(A')^{-1}C$ = $(A^{-1})'C$

$$\Rightarrow X = B'C = \begin{bmatrix} -2 & 9 & 6 \\ 0 & 2 & 1 \\ 1 & -3 & -2 \end{bmatrix} \begin{bmatrix} 9 \\ 4 \\ 3 \end{bmatrix}$$

$$\Rightarrow \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 36 \\ 11 \\ -9 \end{bmatrix}$$

⇒ x = 36 , y = 11 , z = −9 1

Q.34.	Given y = $\log\left[x+\sqrt{x^2+1}\right]$ $\frac{dy}{dx} = \frac{1}{\sqrt{1+x^2}}$ $\sqrt{1+x^2}\ \frac{dy}{dx} = 1$ Again diff. wrt x $\sqrt{1+x^2}\,\frac{d^2y}{dx^2} + \frac{x}{\sqrt{1+x^2}}\frac{dy}{dx} = 0$ $\Rightarrow (x^2+1)\frac{d^2y}{dx^2} + x\frac{dy}{dx} = 0$ **OR** x = a($\theta + \sin\theta$) and y = a($1-\cos\theta$) , find $\frac{d^2y}{dx^2}$ $\frac{dx}{d\theta}$ = a(1+ $\cos\theta$) , $\frac{dy}{d\theta}$ = a(0 + $\sin\theta$) $\therefore \frac{dy}{dx} = \frac{dy}{d\theta} \Big/ \frac{dx}{d\theta} = \frac{a(0+\sin\theta)}{a(1+\cos\theta)} = \tan\frac{\theta}{2}$ $\frac{d^2y}{dx^2} = \frac{d}{dx}\left(\frac{dy}{dx}\right) = \frac{1}{4a}\sec^4\frac{\theta}{2}$	1 1 3 OR 1 1 3
Q.35	The lines are $\frac{x-3}{3}=\frac{y-8}{-1}=\frac{z-3}{1}$ and $\frac{x+3}{-3}=\frac{y+7}{2}=\frac{z-6}{4}$ To write correct formula the shortest distance between the lines = $\frac{\begin{vmatrix} -3-3 & -7-8 & 6-3 \\ 3 & -1 & 1 \\ -3 & 2 & 4 \end{vmatrix}}{\sqrt{(6-3)^2+(12+3)^2+(-4-2)^2}}$ = $\sqrt{270}$ = $3\sqrt{30}$ **OR** the lines are $\frac{x+1}{3}=\frac{y+3}{5}=\frac{z+5}{7}$ and $\frac{x-2}{1}=\frac{y-4}{3}=\frac{z-6}{5}$ $\therefore \begin{vmatrix} x_2-x_1 & y_2-y_1 & z_2-z_1 \\ a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \end{vmatrix} = \begin{vmatrix} 2+1 & 4+3 & 6+5 \\ 3 & 5 & 7 \\ 1 & 3 & 5 \end{vmatrix} = 0$ $\Rightarrow$ Lines are coplanar $\because$ Lines are not parallel $\Rightarrow$ Lines are intersecting To find correct intersecting point ($\frac{1}{2}$, $\frac{-1}{2}$, $\frac{-3}{2}$)	2 1 2 OR 2 1 2
SECTION-E [$4\times 3 = 12$]		
	Case Study-1	
Q.36	(i) The combined area of square and circle in terms of 'x' is = $\left(\frac{x}{4}\right)^2 + \pi\left(\frac{40-x}{2\pi}\right)^2$ (ii) The value of 'x' for which combined area of square and circle is minimum $x = \frac{160}{4+\pi}$ m	1 1

	(iii Radius of circle for minimum combined area of square and circle is = $\frac{20}{4+\pi}$ m Or Finding the correct area =$\frac{400}{4+\pi}$ sq m	2 2
	Case Study-2	
Q.37	(i) Any example of a relation which is neither reflexive nor symmetric but transitive. (ii) The largest equivalence relations on set A = { 1,2,3} is A × A (iii) For giving correct proof that the relation is reflexive For giving correct proof that the relation is symmetric Or For giving correct proof that the relation is Transitive	1 1 1 1 2
	Case Study-3	
Q.38.	(I) the probability of introducing change = $\frac{1}{7} \times 0.8 + \frac{2}{7} \times 0.5 + \frac{4}{7} \times 0.3$ = $\frac{3}{7}$ (II) If the change has been introduced then the probability that it is introduced by A = $\frac{\frac{1}{7}\times0.8}{\frac{1}{7}\times0.8+\frac{2}{7}\times0.5+\frac{4}{7}\times0.3}$ (By Baye's Theorem) = $\frac{4}{15}$	2 2